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STANFORD UNIVERSITY, CALIFORNIA
UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY

FOREST INSECT INVESTIGATIONS

FOREST INSECTS OF CRATER LAKE PARK

by

J.E. PATTERSON

U. S. Bureau of Entomology

Drawings by W.D. EDMONSTON

Forest Insect Laboratory
Stanford University, California
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The insects that occur within the national parks are of interest to man from several widely different viewpoints. Some, such as mosquitoes and biting flies, add to the physical discomfort of the visitor; others, such as butterflies, attract attention because of their marked beauty of pattern and coloring, while still others which feed on trees may have a marked effect on the forest cover and thereby modify certain features of the park itself. This latter group, known as forest insects, includes the forms considered in this section.

To visualize the effect that insects may have on forest cover one has only to visit the areas north of Crater Lake. Here one can see a dead forest extending over 33,000 acres where hundreds of thousands of trees have been killed. This dead forest represents an epidemic of a barkbeetle (*Dendroctonus monticolae* Hopk.) in lodgepole pine which started about 1915. Since that date this beetle has killed all the older trees, leaving only the young trees under six inches in diameter and other species, such as hemlock and fir, which are immune to its attacks. Since 1920 this same type of epidemic has been developing in areas south of Crater Lake. The Park Service has expended nearly \$12,000 in control work in an effort to destroy the beetles and to preserve the forest in the same natural condition as it was when the National Park was set aside.

The artificial control of these insects and a description of the methods employed are beyond the scope of this section and will not be dealt with here. Information on this phase of the subject may be gained by reference to reports of control work done in this park which are on file in the superintendent's office and from the following publications:

Barkbeetles of the Genus *Dendroctonus*; by A.D. Hopkins.
Bulletin 83, Part 1, U.S.D.A., 1909.

Insect Enemies of California Pines and Their Control;
by F.P. Keen. Division of Forestry, State of California, 1928.

Insects of Western North America; by E.O. Essig. The
MacMillan Company, 1926.

CHECK LIST OF THE MORE IMPORTANT FOREST INSECTS OF CRATER LAKE PARK
AND THEIR HOST TREES

(Detailed information on individual insects is arranged alphabetically
by scientific name in text immediately following this list)

INSECT GROUP	STATUS AND HOST TREES	:PAGE
CAMBIUM FEEDERS--Insects that attack and feed on inner bark and cambium		
<u>Dendroctonus brevicomis</u> Lec.	:Most important insect enemy of	: 6
WESTERN PINE BEETLE	: western yellow pine	:
	:	:
<u>Dendroctonus monticolae</u> Hopk.	:Most common barkbeetle of park,	: 7,8
MOUNTAIN PINE BEETLE	: attacking all the pines	: 9
	:	:
<u>Dendroctonus pseudotsugae</u> Hopk.	:A rare insect in the park, found	: 10,
DOUGLAS FIR BEETLE	: only in Douglas fir stands	: 11
	:	:
<u>Dendroctonus valens</u> Lec.	:Very common throughout park; at-	: 12
RED TURPENTINE BEETLE	: tacks bases of dying trees and	:
	: stumps of recently-felled pines	:
	:	:
<u>Ips emarginatus</u> Lec.	:Attacks tops of trees; common in	: 13
LARGE PINE ENGRAVER	: pine stands	:
	:	:
<u>Ips oregoni</u> Eich.	:Most common of engraver beetles,	: 13
OREGON ENGRAVER BEETLE	: attacking all pines	:
	:	:
<u>Melanophila gentilis</u> Lec.	:Very common in sugar pine stands	: 14
GREEN PINE FLATHEAD	: at South Entrance	:
	:	:
<u>Melanophila californica</u> VanD.	:Very common in stands of yellow	: 14
PINE FLATHEAD	: pine	:
	:	:
<u>Melanophila drummondi</u> Kirby	:Attacks all firs and hemlocks;	: 15
FIR FLATHEAD	: adults may be found on freshly-	:
	: cut logs in July and August	:
	:	:
<u>Melanophila acuminata</u> DeG.	:Not common; found in lodgepole	: 15
BLACK FLATHEAD	: forests	:
	:	:
<u>Pityophthorus pseudotsugae</u> Sw.	:Attacks tops and limbs of trees;	: 16
DOUGLAS FIR TWIG BEETLE	: common in fir forests	:
	:	:
<u>Pseudohylesinus granulatus</u> Lec.	:Common in park fir forests	: 17
WHITE FIR BARKBEETLE	:	:
	:	:
<u>Scolytus subscaber(ventralis)</u> Lec.	:Most common barkbeetle near camp:	: 17
WHITE FIR ENGRAVER BEETLE	: ground at Community House; at-	:
	: tacks fir and hemlock	:

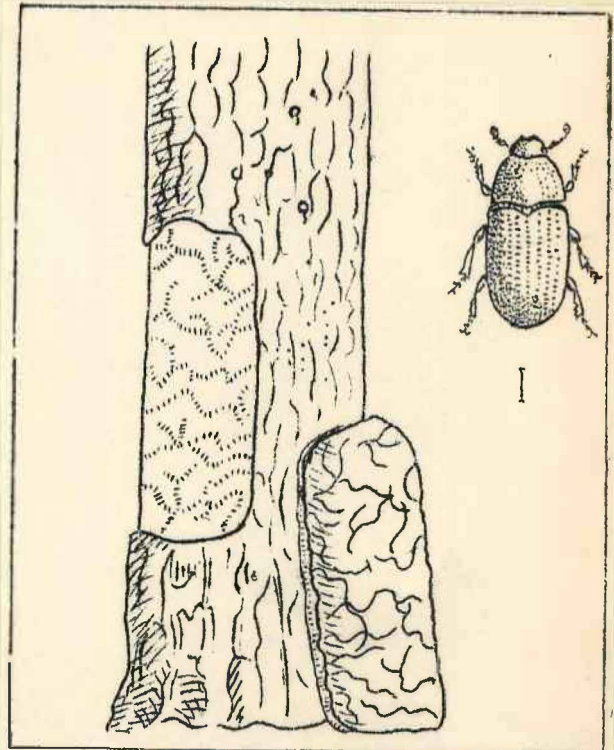
INSECT GROUP	STATUS AND HOST TREES	PAGE
CAMBIUM FEEDERS, conc.		
<u>Tetropium abietis</u> Fall	: Attacks trunks of red and white	: 18
<u>FIR ROUNDHEAD BORER</u>	: fir; found on Wizard Island and	:
	: bet. Anna Spring and Govt. Camp	:
DEFOLIATORS--Insects that attack and feed upon the foliage		
<u>Aspidiotus pini</u> Comst.	: Lodgepole pine; noted as small	: 19
<u>CALIFORNIA PINE SCALE</u>	: black scales on needles	:
<u>Chionaspis pinifoliae</u> Fitch	: White cottony scales found on fo-	: 19
<u>PINE LEAF SCALE</u>	: liage of pines	:
<u>Coloradia pandora</u> Blake	: Large brown moth restricted to	: 20,
<u>PANDORA MOTH</u>	: lodgepole at East Entrance and	: 21
	: yellow pine at South Entrance	:
<u>Halisidota argentata</u> Pack.	: Large spotted moth restricted to	: 22
<u>SILVER-SPOTTED HALISIDOTA</u>	: Douglas fir on Anna Creek near	:
	: South Entrance	:
<u>Pseudohazis eglanterina</u> Bdv.	: Brilliantly-colored brownish-red	: 23
<u>BROWN DAY MOTH</u>	: moth conspicuous in fir timber	:
	: and ceanothus near South Entr.	:
WOOD BORERS--Insects that attack the wood of trunk and limbs		
<u>Asemum atrum</u> Esch.	: Most common wood borer of park;	: 24
<u>BLACK SPRUCE BORER</u>	: found throughout the forests in	:
	: down and dying trees	:
<u>Rhagium lineatum</u> Oliv.	: Wood borer in pines; not common	: 24
<u>RIBBED PINE BORER</u>	: in this park	:
<u>Buprestis aurulenta</u> Linn.	: Attacks all pines of park, also	: 25
<u>GOLDEN BUPRESTID</u>	: Douglas fir; beautiful green and:	:
	: gold beetle very common through-	:
	: out the park	:
<u>Buprestis rusticorum</u> Kirby	: Common wood borer of Douglas fir,	: 25
<u>RUSTIC BORER</u>	: though rather rare in the park	:
<u>Chalcophora angulicollis</u> Lec.	: Common wood borer of all pines;	: 26
<u>SCULPTURED PINE BORER</u>	: one of the larger forest insects:	:
<u>Ergates spiculatus</u> Lec.	: Largest of wood-boring beetles;	: 27
<u>GIANT PINE BORER</u>	: adults may be found under loose	:
	: bark at base of dead pine trees	:
<u>Tragosoma harrisi</u> Lec.	: Large brown beetle common in dead:	: 27
<u>HARRIS' PINE BORER</u>	: pine forests near Government	:
	: Camp and at East Entrance	:

INSECT GROUP	STATUS AND HOST TREES	PAGE
WOOD BORERS, conc.		
<u>Monochamus maculosus</u> Hald.	:Lodgepole pine, Douglas fir; large:	28
WESTERN PINE SAWYER	: brown spotted wood borer very	
	: common throughout the park	
<u>Monochamus oregonensis</u> Lec.	:White and red fir; large, conspic-	28
BLACK PINE SAWYER	: uous wood borer of fir forests	
	<i>Quercus Cedrus</i>	
<u>Semanotus ligneus</u> Fabr.	:White and red fir; this spotted	29
FIR SAPWOOD BORER	: wood borer is common in fir for-	
	: ests	
CONE INSECTS--Insects that attack flowers, cones and seeds		
<u>Barbara colfaxiana</u> Kearf.	:Small tan and gray moth found on-	30
FIR CONE MOTH	: ly in cones of Douglas fir	
<u>Barbara colfaxiana siskiyouana</u> K.	:White and red fir; small gray	30
WHITE FIR CONE MOTH	: cone moth not common in the park:	
<u>Eucosma rescissoriana</u> Hein.	:Small brown moth very common in	30
BROWN CONE MOTH	: lower-elev. pine forests of park:	
<u>Conophthorus ponderosae</u> Hopk.	:Yellow pine; the cone beetles at-	31
YELLOW PINE CONE BEETLE	: tack and kill cones before they	
	: mature; the dead cones drop from:	
	: the tree and may be found on the:	
	: ground beneath; breaking open	
	: these dwarfed cones reveals the	
	: adult beetles	
<u>Conophthorus contortae</u> Hopk.	:Lodgepole pine	32
LODGEPOLE PINE CONE BEETLE		
<u>Conophthorus lambertiana</u> Hopk.	:Sugar pine	32
SUGAR PINE CONE BEETLE		
<u>Dioryctria abietella</u> D&S	:A medium-sized grayish moth very	33
CONE PYRALID	: common throughout the park for-	
	: ests; the caterpillars bore	
	: large galleries in the cones	
<u>Eucymatoge spermophaga</u> Dyar	:Medium-sized grayish moth of fir	33
CONE GEOMETRID	: and hemlock forests	
<u>Holcocera angusti</u> Hein.	:Light tan and grayish moth re-	33
CONE TINEID	: stricted to cones of Douglas fir:	
<u>Laspeyresia piperana</u> Kearf.	:Yellow pine; small metallic moth	34
YELLOW PINE CONE MOTH	: which bores pith of cones; com-	
<i>Sled</i>	: mon at South Entrance	

INSECT GROUP	:	STATUS AND HOST TREES	:	PAGE
<i>Cone Dusets</i>	:		:	
WOOD BORERS , conc.	:		:	
	:		:	
<u>Laspeyresia youngana</u> Kearf.	:	Engelmann spruce; small metallic	:	34
SPRUCE CONE MOTH	:	moth common in spruce of both	:	
<i>Seed</i>	:	Anna Creek and Sand Creek Can-	:	
	:	yons	:	
	:		:	
<u>Megastigmus albifrons</u> Walk.	:	Yellow pine	:	The seed chalcids : 35
PINE SEED CHALCID	:		:	are small wasp-
	:		:	like insects which:
<u>Megastigmus pinus</u> Parfitt	:	White fir	:	attack the seeds :
FIR SEED CHALCID	:	Red fir	:	of conifers. They:
	:		:	are very plentiful:
<u>Megastigmus spermotrophus</u> Wach.	:	Douglas fir	:	in the park but on: 35
DOUGLAS FIR SEED CHALCID	:		:	account of their :
	:		:	small size are eas-
<u>Megastigmus picea</u> Roh.	:	Engelmann	:	ily overlooked. : 35
SPRUCE SEED CHALCID	:	Spruce	:	They may be found :
	:		:	in the cones of :
<u>Megastigmus tsugae</u> Roh.	:	Mountain	:	the species they : 36
HEMLOCK SEED CHALCID	:	Hemlock	:	attack :

THE WESTERN PINE BEETLE
(*Dendroctonus brevicornis* Lec.)

DESCRIPTION. The adult is a small, brown to black, cylindrical, rather stout beetle with body somewhat smaller than the ordinary housefly, or slightly over $\frac{1}{8}$ inch in length. The larvae are small, white, legless grubs, less than $\frac{1}{4}$ inch long, with small yellow heads. They may be found by slicing halfway through the bark of an infested yellow pine; if the tree is at all heavily infested a few dozen of them will be exposed in a small section of bark. It is difficult to see these beetles while in flight or resting on a tree because of their small size and dark color. However, the adults may be found after they attack a tree upon removal of a section of bark; this exposes their galleries on the surface of the sapwood. Each gallery will have one or more beetles in it. Early evidence of attack is furnished by the presence of "pitch tubes" in the bark crevices. The beetle may be identified by the characteristic irregular, winding egg galleries, which are peculiar to this species.



Adult beetle, enlarged 4x, and lower trunk of infested yellow pine, showing galleries on sapwood and on inner surface of bark section.

OCCURRENCE. This beetle is found in only one place in the park--the yellow pine stands at the South Entrance.

HOST. It attacks only western yellow pine.

HABITS AND LIFE HISTORY. It kills the trees by boring through the outer bark and gnawing tunnels through the cambium layer, completely girdling the tree and cutting off its sap. Very few trees are able to resist the beetles when they attack in numbers. The parents mine the inner bark, construct egg galleries and deposit eggs, which hatch in about 7 days. The grubs feed upon the inner bark and cambium and bore out through the inner into the outer bark. Here they complete their growth, change to pupae, then to new adults, and finally emerge from the trees, leaving round exit holes in the bark, so that the tree from which many beetles have emerged looks as if it had been peppered with small shot.

LIFE HISTORY SYNOPSIS. There are two generations each year in the park.

	First Brood	Second Brood
Emerg. of adults, flight and attack -	June, July	September, October
Eggs - - - - -	" "	" "
Larvae - - - - -	" " Aug.	Sep., Oct., Nov. & until May of next year.
Pupae - - - - -	July, August	May, June.

BIBLIOGRAPHY. Chamberlin, W.J. 1920 Bul. 172, Or. Agr. Col. Exp. Sta.
Hopkins, A.D. 1909 " 83, Pt. 1, U.S.D.A.
Webb, J.L. 1906 " 58, " 2, "

THE MOUNTAIN PINE BEETLE
(Dendroctonus monticolae Hopk.)

DESCRIPTION. The adult mountain pine beetle is a hardshelled, cylindrical insect about $3/16$ inch long and black in color. It is comparable in shape and size to a grain of wheat. The egg of this beetle is oval, pearl-white, $1/32$ inch long and has a glossy surface. The full-grown grub is white, cylindrical, slightly curved, has a broad head and is about $3/16$ inch long. The pupa is white, about the same size as the grub, and bears rows of fleshy spines on its abdomen. The newly-formed young beetle is brown.

OCCURRENCE. This beetle is found throughout the park, and is very common in the lodgepole pine forests wherever this type occurs. It may be found locally at Anna Spring, Government Camp, Lost Creek in Pinnacles Valley and at points on the rim near the Community House and at Cleetwood Cove.

HOSTS. It attacks many species of coniferous trees. In the park it attacks and kills lodgepole pine, mountain pine, yellow pine, sugar pine, whitebark pine and Engelmann spruce. Its attacks on a tree are confined to the main trunk and the base of the larger limbs. The larger and older trees are preferred, though it attacks specimens down to sapling size. It enters the cambium layer of the inner bark by boring entrance holes through the outer bark. After entrance into the cambium, longitudinal galleries of some length are excavated on the surface of the sapwood. The eggs are laid in niches along the sides of these galleries.

EVIDENCE OF INFESTATION. The first evidence of the presence of this beetle in an attacked tree is the reddish boring dust which falls from the entrance holes. This dust adheres in the bark crevices and accumulates on the ground at the base of the tree. Soon afterward resin exudes from the entrance holes and forms masses of pitch at these points. These resin masses are called "pitch tubes" and are unmistakable evidence of attack. These first indications of attack are followed by physical changes in the tree; the needles soon turn to a yellowish-white color, and from two to eight months later the entire foliage turns a brick-red. This indicates that the tree is dead and partially dried out. By the end of July of the year after attack the bark of the main trunk is marked by a number of circular holes about $1/16$ inch in diameter. These are the exit holes, by way of which beetles of the new brood emerge from the tree. During the succeeding fall and winter periods the dead needles fall from the tree. By the third year the bark starts to fall from the trunk and soon the bare trunk and limbs are exposed. These stark and bleached trees form the popularly known "ghost forests" of Crater Lake and Yosemite Parks.

LIFE HISTORY.

The season of activity of the mountain pine beetle varies slightly with elevation and climatic conditions. In this park it usually begins early in May and continues until late September. The emergence of beetles that have overwintered in attacked trees begins during the latter part of June and continues until August 1. The attack of new trees also corresponds to this period. Egg laying is begun within a few days after attack starts and is continued until late August. Larvae begin to hatch during the early part of July and continue to hatch and feed until late in September, when winter conditions set in and the broods become dormant. The broods pass the winter mainly as larvae (in various stages of development), though some parent adults also live through the winter period. Activity of the overwinter broods is resumed early in May. The old parent adults lay eggs which hatch, and these larvae, together with those which have been dormant through the winter, feed until early in June, when pupation takes place. This is followed by transformation to new adults. These adults emerge from the trees during July and August. This completes the full life cycle. In the lower elevations of the park, Sand Creek and Pinnacles Valley, the seasonal activity is accelerated by the warmer climate, so that some broods develop more rapidly, emerging and attacking during the fall of the same season. However, these variants represent only a small part of the main brood, and the development of the majority is consistent with the above outline.

The various stages of development in which this beetle may be found in Crater Lake Park during each month of the year are shown in the following life history synopsis:

Emergence of adults and attack of new trees: July, August, September.

Eggs: July, August, September.

Larvae: Hatching, July, August, September.

Feeding, July, August, September, October, May, June.

Dormant, Late October, November, December, January, February, March, April.

Pupae, June, July.

New Adults, June, July, August (September).

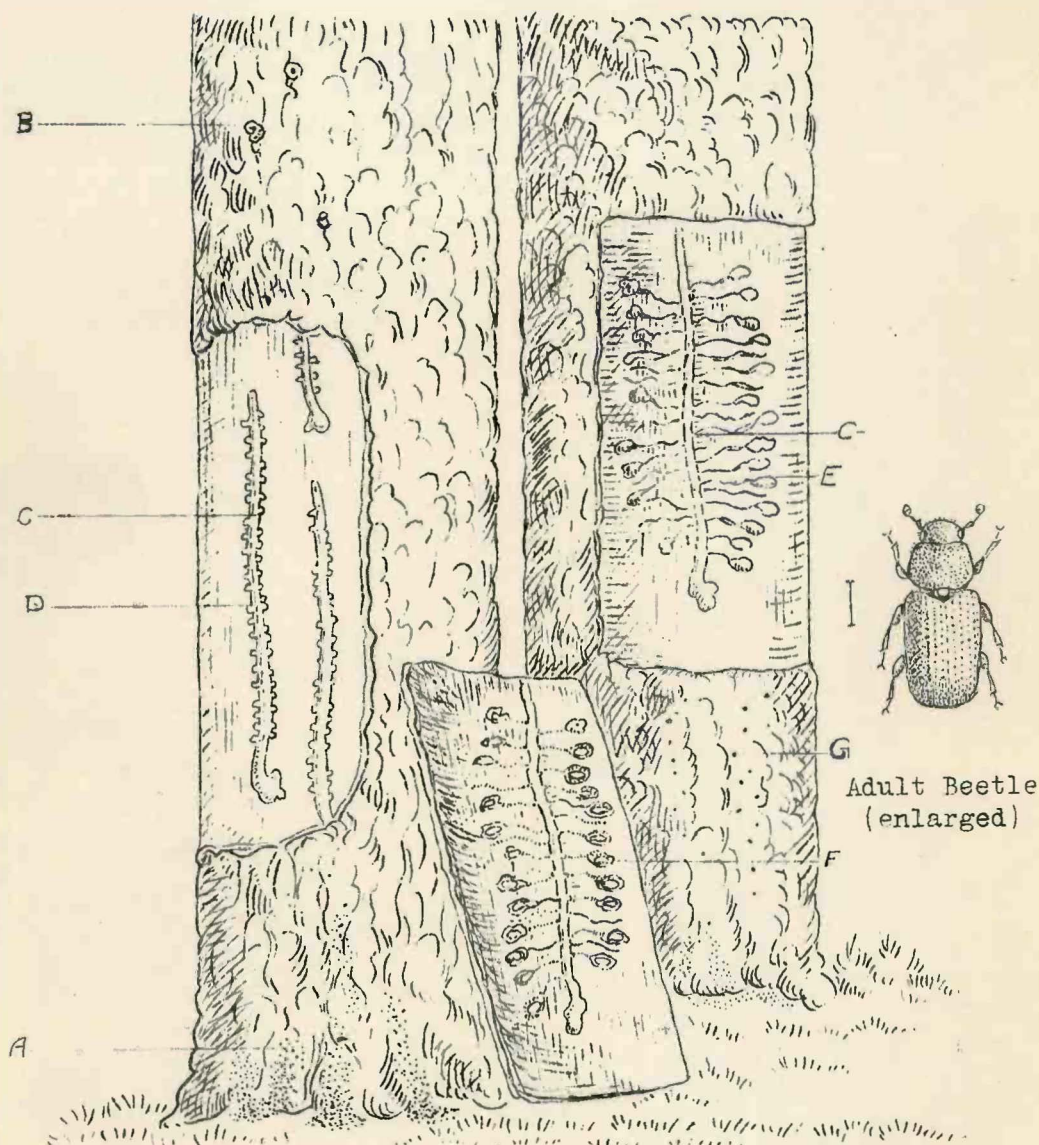
Old Adults in overwintering trees, September, October, November, December, January, February, March, April, May.

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| Hopkins, A.D. | 1909 | U.S.D.A.Bur.Ent.Bul.83, Pt.1, pp.80-90. |
| Hopping, Ralph | 1921 | Dept.Agr.Ent.Br., Dom.Can., Circ.No.5. |
| Swaine, J.M. | 1914 | Dept.Agr.Div.Ent.Bul.No.7, pp.26-28. |

THE MOUNTAIN PINE BEETLE, Dendroctonus monticolae Hopk.

Illustrating adult beetle (enlarged), external evidence of attack and development of brood under the bark



- A - Boring dust; small pieces of bark from the entrance holes made by the parent beetles in attack
- B - Pitch tubes; masses of resin which form on the surface of the bark at the entrance holes
- C - Egg galleries; longitudinal burrows made under the bark by the female beetles for reception of eggs
- D - Eggs; these are laid in niches along the sides of the galleries
- E - Larval mines and pupal cells; these are made in the cambium by the grubs during the feeding stage
- F - Larva and pupa in pupal cells in the inner bark; transformation to the adult beetle takes place in these cells
- G - Exit holes; small round holes made through the outer bark by the emerging new adults

THE DOUGLAS FIR BEETLE
(Dendroctonus pseudotsugae Hopk.)

DESCRIPTION

The adult is a small reddish to blackish-brown cylindrical beetle, a trifle larger than the mountain pine beetle, which it closely resembles. The larvae are small white legless grubs with yellow heads. They are very similar in appearance to the larvae of the other barkbeetles and cannot always be distinguished with certainty. They may be found during the summer season by removing the bark from dying or recently cut Douglas fir trees. The broods occupy the cambium layer between the outer bark and the sapwood. This beetle may be identified by the characteristic straight, longitudinal egg galleries, with radiating larval burrows.

OCCURRENCE

Its occurrence in the park is restricted to local areas at the South Entrance and on Castle Creek east of the West Entrance.

HOST

In this park it attacks only Douglas fir.

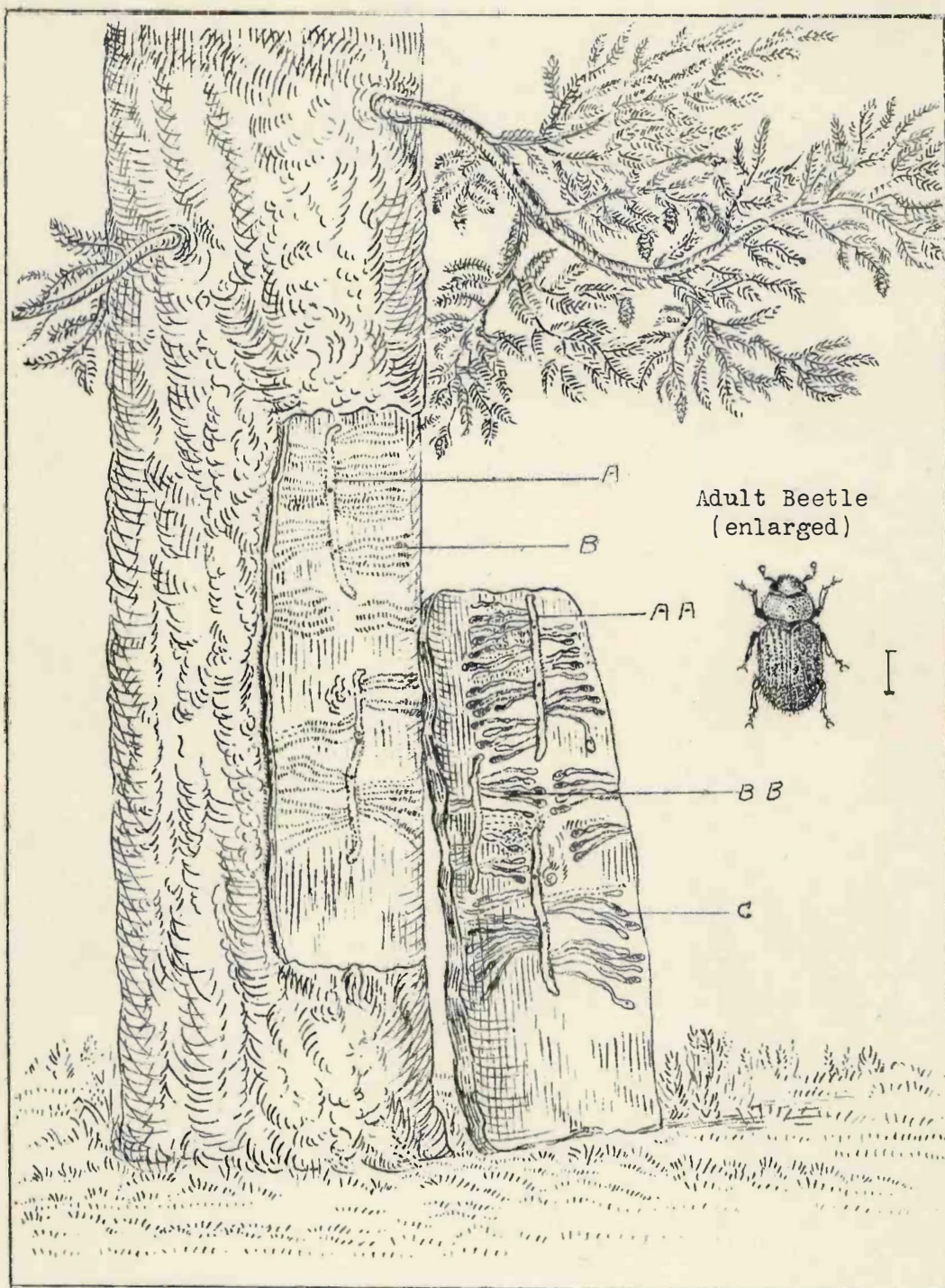
HABITS AND LIFE HISTORY

The Douglas fir beetle usually confines its attacks in this park to dying trees or recently-felled timber, rarely attacking healthy trees. Windfalls, green sections of trees cut for utilization, snow-broken main trunks, and stumps, are favorable breeding material. Attacks are made by the parent beetles boring through the outer corky bark to the surface of the sapwood. The entrance holes are usually made in the bark crevices, and are indicated by copious amounts of boring dust of a reddish color which surround them. The eggs are placed in alternate groups along both sides of the parent gallery. The larvae upon hatching excavate food burrows radiating from the groups of egg niches. Pupae form in cells either on the surface of the sapwood or concealed in the inner surface of the bark. Emergence of adults and attack occur in June, July and August. The broods pass the winter in attacked trees or logs, principally as new adults and young to full-grown larvae. They emerge the following summer.

LITERATURE

Chamberlin, W.J. 1918 Oreg.Agr.Col.Exp.Sta.Bul.147.

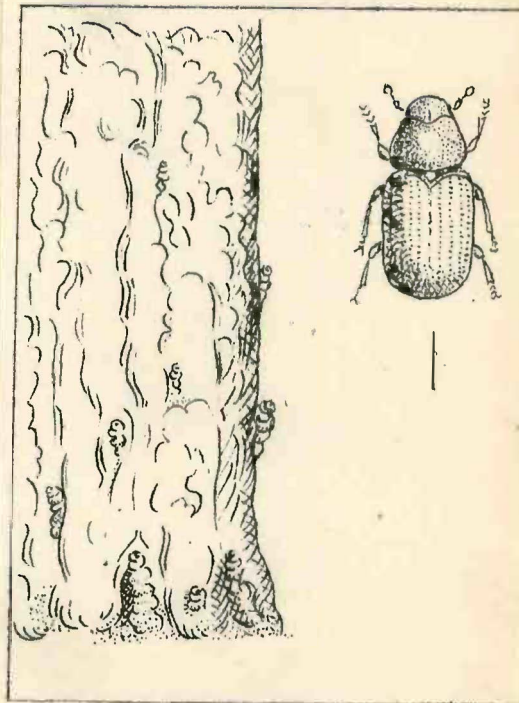
Illustrating adult beetle (enlarged)
and characteristic work under bark



- A - Egg gallery scoring on surface of sapwood
- AA - Egg gallery on inner surface of bark
- B - Larval mines on surface of sapwood
- BB - Larval mines on inner surface of bark
- C - Pupal cells on inner surface of bark

THE RED TURPENTINE BEETLE
(Dendroctonus valens Lec.)

DESCRIPTION. The adults are large, stout, light to dark red, cylindrical beetles from $\frac{1}{4}$ to $\frac{3}{8}$ inch in length, the entire body sparsely clothed with long hairs. It is easily recognized by its work. Large masses of pitch mixed with reddish boring dust exuding from circular holes at the base of pines are almost certain evidence of its presence, while under the bark will usually be found the adult beetles and larvae working together to excavate a large cavity between bark and wood. The adult beetles while in flight are strongly attracted to freshly-cut lumber and alight on buildings when such material is used in construction. They have been known to alight on tents in the camp-grounds during July and August. The larvae are white, legless grubs with reddish heads; they feed en masse under the bark at the base of the trees and on the roots.



OCCURRENCE. This beetle occurs throughout the park, being very common in the pine stands. It should be looked for locally near the South Entrance, at Anna Spring and in Pinnacles Valley.

Adult red turpentine beetle and base of infested yellow pine tree, showing pitch tubes; beetle enlarged 3x.

HOSTS. It attacks all species of pines occurring within the park.

HABITS AND LIFE HISTORY. The beetles pass the winter under the bark of attacked trees in the form of parent adults, larvae and new adults. Adults emerge during the period June 15-September 1. During the same period new trees are attacked and eggs laid. The eggs hatch within a week or ten days and the larvae feed until hibernation begins, or else transform to pupae and then to new adults before the dormant winter period. The adults attack stumps, cut logs and the base of living trees. The larvae eat out cavities in the inner bark and extend their work several feet up the trunk or occasionally for many feet below the soil in the roots. A record length of 15 feet was made by one ambitious beetle on the root of a yellow pine stump. This gallery was uncovered and measured, and at the end was found the beetle still at work industriously extending it farther.

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Paper 392, Jour. Ser. Agr. Exp. Sta., Minnesota
Hopkins, A.D. 1909 Barkbeetles of the Genus Dendroctonus; Bul.
83, Pt. 1, U.S.D.A.

THE OREGON ENGRAVER BEETLE
(*Ips oregoni* Eich.)

DESCRIPTION. The adults are small, reddish to black, cylindrical beetles with 4 spines on the posterior margin of the wing covers. They compare in size with the mountain pine beetle. The larvae are small white legless grubs, somewhat thicker at the front end. The pupae are white and very active. Like other barkbeetles they are difficult to find after leaving the host tree. Adults, as well as individuals in other stages, may be found any time during the summer months by removing the bark from infested trees and logs. The broods will be found under the bark on the surface of the sapwood. Evidence of the presence of this beetle in attacked trees is furnished by red boring dust on the outer surface of the bark. On the tops of down logs this dust when pushed out by the beetles forms small pyramids over the entrance holes.

OCCURRENCE. Found throughout the pine stands of the park. Local places to look for it are Anna Spring, Munson Valley and Pinnacles Valley.

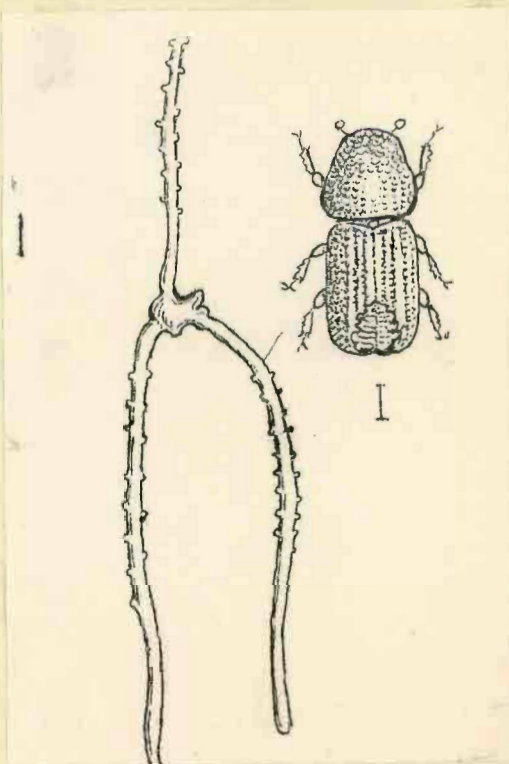
HOSTS. It attacks yellow pine, sugar pine, mountain pine and whitebark pine.

HABITS AND LIFE HISTORY. The adult beetles attack a tree by boring through the bark to the cambium layer. Here they construct egg galleries shaped somewhat like an inverted Y. The eggs are deposited along the sides of these galleries. After hatching, the larvae gnaw food burrows which radiate from the parent gallery. Pupae form in cells in the cambium layer at the end of the food burrows. The new adults collect in the parent galleries and emerge through common exit holes. There are from 3 to 4 generations each year in the park, so that it is possible to find beetles in the various stages of development at any time during the park season.

THE LARGE PINE ENGRAVER
(*Ips emarginatus* Lec.)

This is the largest engraver beetle in the park and is distinguished from the Oregon engraver beetle by having 4 ^{irregular} spines on the elytral declivity. Its work is characterized by the long, straight, nearly parallel galleries, which extend up and down the tree and connect at different points. There are two generations each year in the park, so that adults may be found throughout the summer months. The species attacks yellow pine, sugar pine, lodgepole pine, mountain pine, and is found throughout the park.

LITERATURE. Swaine. J.M. 1918 Canadian Barkbeetles; Bul.14, Dept. Agr. Ent., Canada.



Adult beetle enlarged 4x

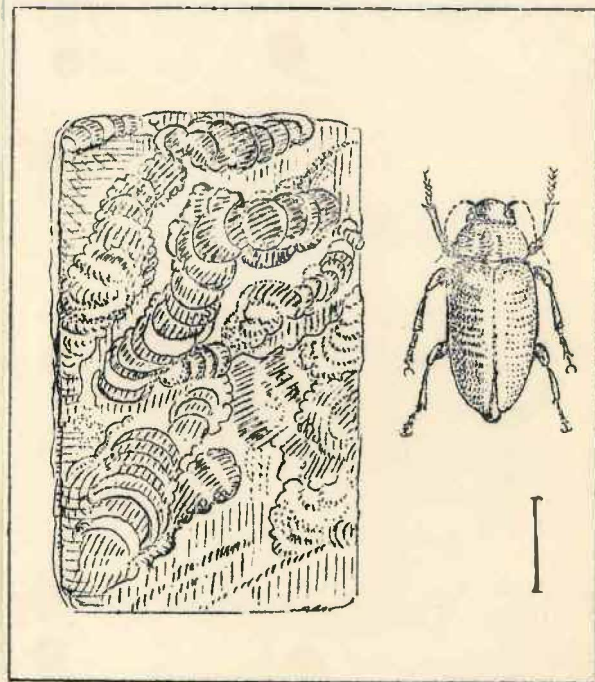
THE GREEN PINE FLATHEAD
(*Melanophila gentilis* Lec.)

DESCRIPTION. The adult beetles are a bright bluish-green color and about one-half inch in length. They are ovate in shape, rather sharply pointed posteriorly, with a smooth, glossy upper surface. The larvae are white, legless, with a broad and flattened head. They work under the bark, making flat winding mines which are well packed with coarse boring dust. This beetle, as well as the closely related forms, is easily recognized in the adult stage by the flattened body and metallic sheen. The larvae are distinguished by the broad and flattened head region and the narrowed posterior parts.

OCCURRENCE. It is found generally throughout the lower elevations of the park, being quite common near the South Entrance.

HOSTS. It attacks both sugar pine and mountain pine.

HABITS AND SEASONAL HISTORY. The adults fly during June and July. The eggs are laid on the surface of the bark, and after hatching the young grubs bore through the outer bark to the cambium layer, where they excavate winding food burrows. After the grubs become full-grown they bore out through the corky bark to near the surface, where they excavate ovate cells in which transformation to the adult beetle takes place. The winter period is passed principally in the larval stage, though some new adults hibernate before emerging. This beetle attacks injured and dying trees, freshly-cut slash and even healthy trees.



Adult green pine flathead and larval
burrows on inner surface of bark

THE PINE FLATHEAD
(*Melanophila californica* VanD.)

This beetle is very similar to the preceding, but is of a greenish-bronze color instead of bright green. It attacks western yellow pine. Its habits and life history are not different from the green flathead. Adults are quite common in June and July in the pine stands at the South Entrance.

THE FIR FLATHEAD
(Melanophila drummondi Kirby)

In size and form this beetle closely resembles the preceding. It is of a metallic bronze color with iridescent sheen. Some individuals have bright golden spots on the elytra, though this character is not constant, being entirely absent in others. It attacks Douglas fir, red fir and mountain hemlock and is common throughout the park.

THE BLACK FLATHEAD
(Melanophila acuminata DeG.)

Similar to above except in color, which is dull brownish-black without metallic sheen. It attacks lodgepole pine and is found throughout the park, though not common in any certain locality. Adults have been collected in Pinnacles Valley and at Anna Spring. It should be looked for in July around lodgepole pine trees which were killed the previous season by the mountain pine beetle.

LITERATURE. Burke, H.E. 1919 Jour.Econ.Ent.,Vol.12,pp.105-108.

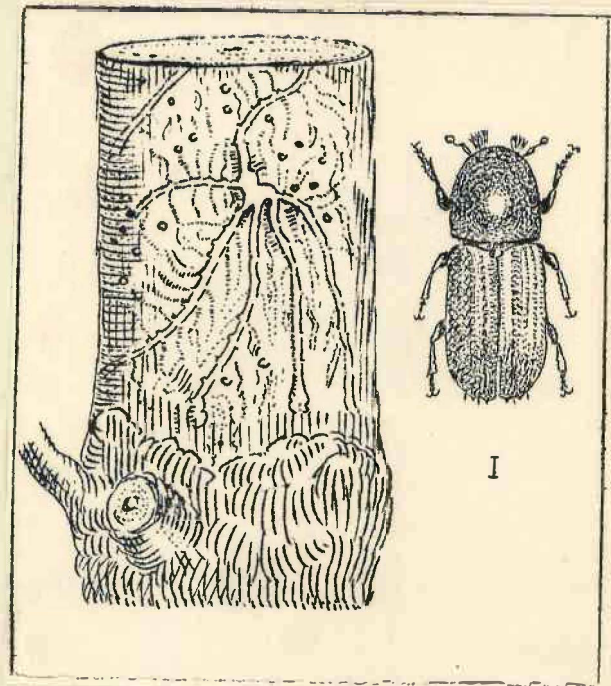
THE DOUGLAS FIR TWIG BEETLE
(*Pityophthorus pseudotsugae* Sw.)

DESCRIPTION. A small dark reddish-brown cylindrical beetle about 1/16 inch long. It closely resembles other twig beetles and cannot be readily distinguished in the field. The characteristic five- or six-prong egg galleries which radiate from a common central chamber will serve to identify it.

OCCURRENCE. It occurs throughout the park in the fir stands. The beetles are quite common, though not conspicuous because of their minute size and dark color. Local places where they may be found are the Cascade Divide west of Anna Spring, Union Peak, Vidae Ridge, Mount Scott, Wheeler Creek and Wild-cat Camp.

HOSTS. In the park it attacks the twigs and tops of Douglas fir, white fir and red fir.

HABITS AND SEASONAL HISTORY. Adults attack the twigs and small sections of the tops of trees. The attacked limbs and tops usually die and the foliage turns red at about the time the new beetles emerge. The eggs are laid in short galleries which radiate from the entrance chamber. The larvae feed in burrows which extend away from the egg galleries and these, together with the parent galleries, form an intricate pattern on the inner bark and surface of the sapwood. Pupation occurs in cells either on the surface of the sapwood or within it. The adults fly in June and July.



Adult beetle and egg galleries

LITERATURE.

Swaine, J.M. 1918 Canadian Barkbeetles, Pt.II, pp.99,100;
Bul.14, Dep.Agr.Ent., Canada.

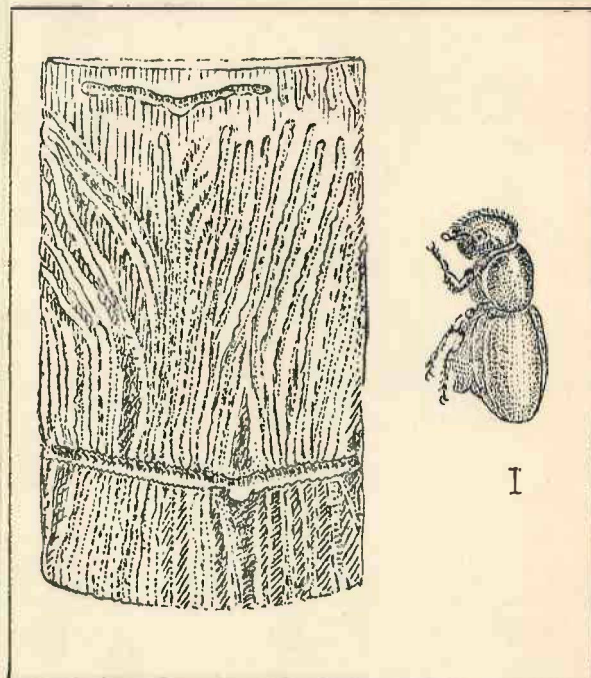
THE WHITE FIR ENGRAVER BEETLE
(*Scolytus subscaber* (*ventralis*) Lec.)

DESCRIPTION. The white fir engraver is a small, shortened, brownish-black beetle 1/8 inch long. The distinguishing adult character of this species is an abrupt foreshortening of the posterior portion of the body.

OCCURRENCE. This beetle occurs throughout the park fir forests. It is found locally in Munson Valley, Anna Spring and in Pinnacles Valley.

HOSTS. It attacks Douglas fir, white fir, red fir and mountain hemlock.

HABITS AND SEASONAL HISTORY. The adults construct transverse galleries in the cambium of the bark which deeply score the surface of the sapwood. The larvae mine out food burrows at right angles to the parent gallery. In the park the adults fly and attack during July and August.



White fir engraver beetle and work

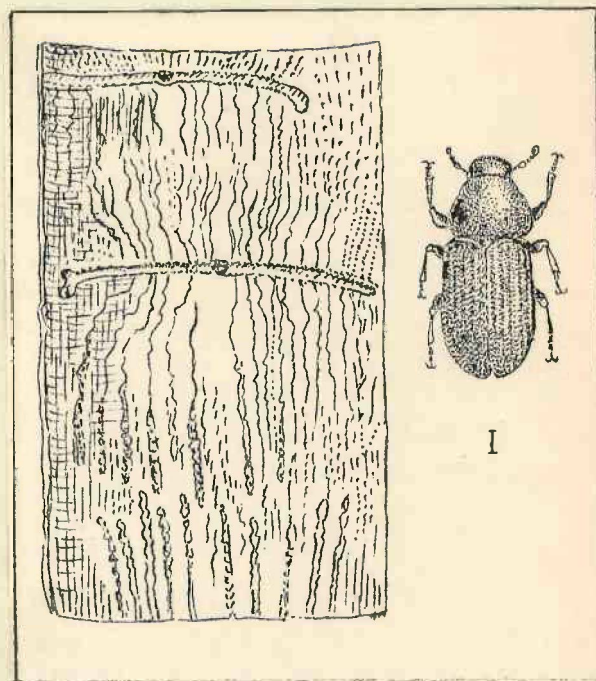
THE WHITE FIR BARKBEETLE
(*Pseudohylesinus granulatus* Lec.)

DESCRIPTION. This species is a small brown elongated beetle about 1/8 inch in length. The body is profusely covered with short light-brown hairs and the elytra is deeply punctured.

OCCURRENCE. The white fir barkbeetle is found throughout the park fir forests.

HOSTS. It attacks both white and red fir.

HABITS AND SEASONAL HISTORY. The adults make their attacks by boring through the outer bark to the surface of the sapwood, where short transverse egg galleries are constructed. The larval food burrows are excavated at right angles to the egg gallery. The pattern of these galleries is usually quite symmetrical and characteristic of the beetle. The adults fly and attack in this park during July and August.



White fir barkbeetle and galleries

THE FIR ROUNDHEAD BORER
(*Tetropium abietis* Fall)

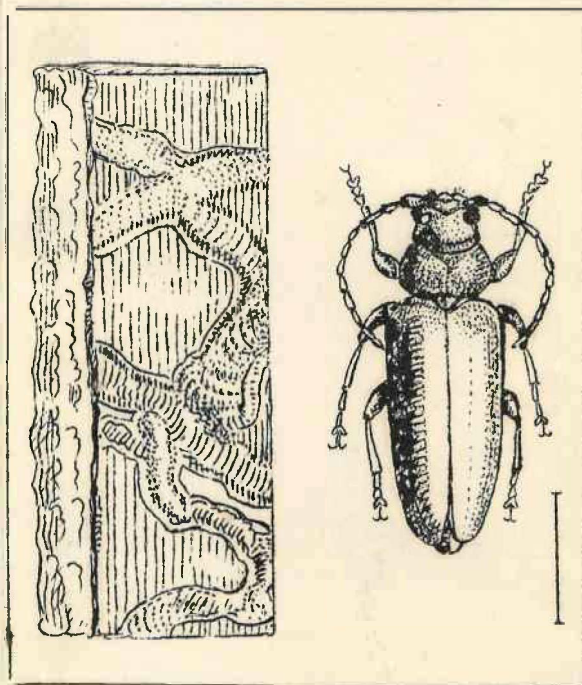
DESCRIPTION. The fir roundhead is a medium-sized, dark-brown, slender beetle about $\frac{3}{4}$ inch in length. It is characterized by a smooth, shining dorsal surface. The larval burrows are made between the sapwood and inner bark, deeply scoring both. They are long and winding, forming an intricate pattern, and are firmly packed with pitchy boring dust.

OCCURRENCE. It occurs throughout the park, being quite common on the Rim near the community house, at Government Camp, Anna Spring, Sun Notch and in Pinjacles Valley. Adults have also been taken on Wizard Island, where it attacks the noble fir.

HOSTS. White fir, red fir and noble fir.

HABITS AND SEASONAL HISTORY.

The adults attack both healthy and dying trees, being especially attracted to fire-injured stock. The eggs are deposited in the crevices of the bark. The larvae bore into the cambium layer and then construct their long, winding food burrows. Pupae form in oval cells in the outer corky bark. In the park the adults fly and attack during June and July. There is one generation annually in these forests.



Adult beetle and section of larval gallery on inner surface of bark

THE CALIFORNIA PINE SCALE
(Aspidiotus pini Comst.)

DESCRIPTION. The California pine scale is an elongate oval scale about 1/16 inch in diameter and of a yellowish-brown to black color. It usually occurs on the middle portion of the host needles.

OCCURRENCE. This scale is quite common in the lodgepole forests of the lower elevations. It may be found in Pinnacles Valley and at Anna Spring.

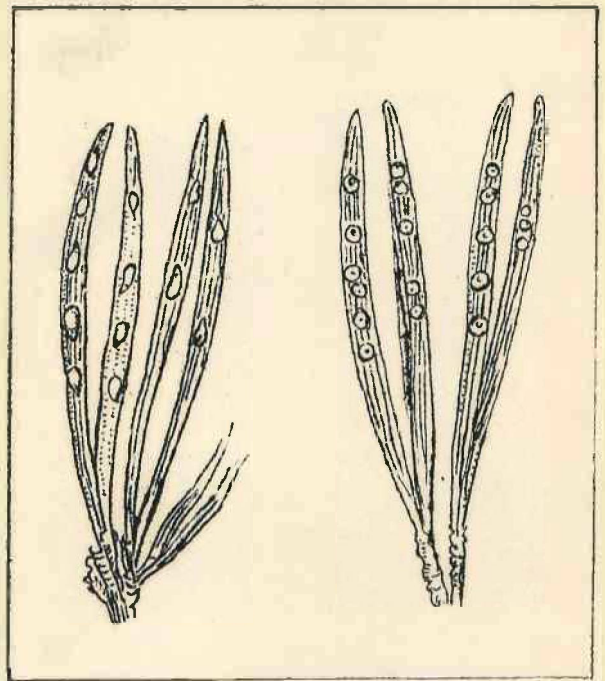
HOST. In this park it attacks lodgepole pine and yellow pine.

THE PINE LEAF SCALE
(Chionaspis pinifoliae Fitch)

DESCRIPTION. This species is a narrow, elongate, white scale about 1/8 inch in length. It occurs quite thickly on the needles of its hosts, and being white contrasts strongly with the dark green color of the needles.

OCCURRENCE. Locally at the South Entrance.

HOSTS. Western yellow pine, sugar pine and mountain pine.



Chionaspis
pinifoliae

Aspidiotus
pini

Both species cause considerable injury and weakening of the attacked trees through sucking the juices of the foliage. The affected needles turn yellow and die.

THE PANDORA MOTH
(Coloradia pandora Blake)

DESCRIPTION. The adult Pandora is a large brownish-gray moth of the silkworm family. During the mating period they may be seen flying about in the forest during mid-afternoon. In flight their large size and conspicuous coloring may cause them to be mistaken for some of the brightly-colored wood warblers, though the flight is more erratic. The wing spread of these moths is about $3\frac{1}{4}$ inches and the body is large and dark brown. The wings are each marked with a large dark spot or disc, and the inner margins are covered with long, wine-colored hairs.

OCCURRENCE. The Pandora is found at only two places in Crater Lake Park. It has been quite common in Pinnacles Valley and also at the South Entrance, as well as in the Mono Lake region, east of Yosemite National Park.

HOSTS. In this park it attacks only yellow pine and lodgepole pine. Vast areas of pine on the adjacent Klamath Indian Reservation have been defoliated by the caterpillars. Its epidemics are usually periodic at intervals of about twenty years. In past years it was a staple food item of the Indians. There are authentic records of the Klamath Indians roasting and eating the pupae. These were called "Bull Quanch" and were considered a delicacy. The Paiute Indians in California dry the caterpillars for food. In this form they resemble snails and are called "Peage" by these Indians.

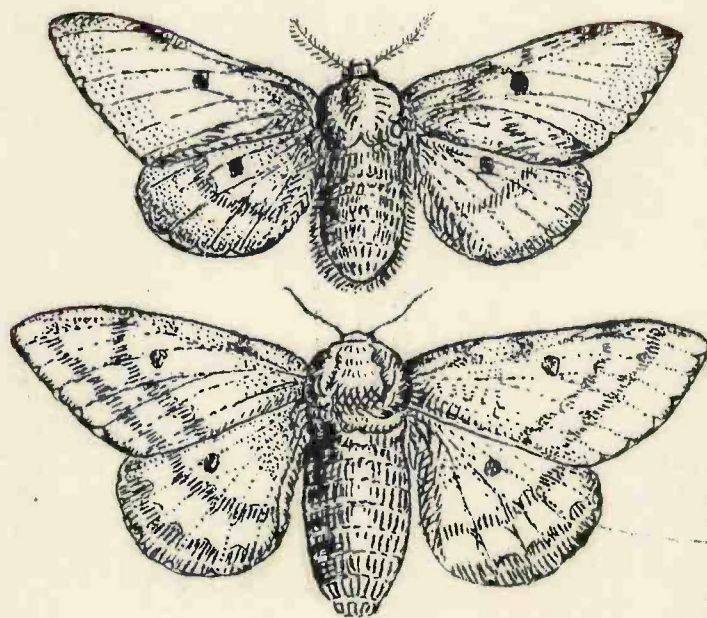
HABITS AND LIFE HISTORY. The female moth lays her eggs on the needles and trunk of the host tree, and even on surrounding brush and ground litter. Immediately after hatching the young caterpillars begin to feed on the needles. They gather in colonies during the late fall and pass the first winter in the foliage of the trees. During the prepupal stage they are quite large and consume an enormous quantity of food, each eating from four to seven needles per day. The result of this voracious feeding is thorough defoliation of many attacked trees. The full-grown caterpillars enter the ground to pupate. They remain in the pupal stage one entire year before emerging as adults.

LIFE HISTORY SYNOPSIS.

Emergence of adults, flight and attack: June 20-July 31.
Eggs: June 25-August 25.
Caterpillars: August 1-June 30 of following year.
Pupae: June 20-July 10 of next succeeding year.
The complete life cycle covers a period of two full years.

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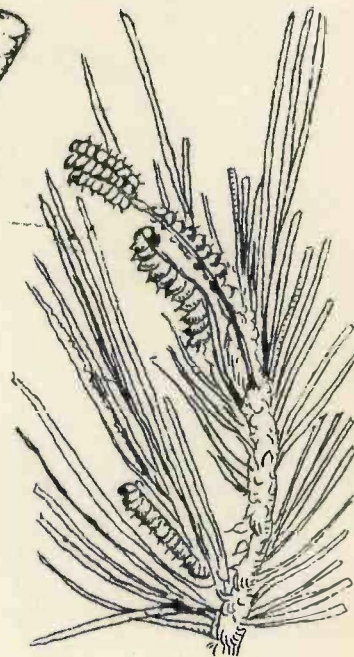
- Aldrich, J.M. 1912 Jour.N.Y.Ent.Soc.,Vol.20,pp.28-31, 1 pl. An account of the use of caterpillars as food by the Indians.
- Miller, J.M. and Hutchinson, Wallace 1928 Nature Magazine,Vol. 12,No.3,pp.158-160. Account of caterpillars being used for food by the Mono and Piute Indians.
- Patterson, J.E. The Pandora Moth, An Enemy of Western Pine Forests. Ms. (now in process of publication by U.S.D.A.



Male and female
natural size



Pupa



Caterpillars in first
spring feeding stage

THE PANDORA MOTH, Coloradia pandora Blake

Illustrating life-size adult moths and pupa
and small caterpillars feeding on yellow pine needles

THE SILVER-SPOTTED HALISIDOTA
(Halisidota argentata Pack.)

DESCRIPTION. The adults are yellowish-brown moths of medium-large size, measuring nearly two inches in wing expanse and having large bodies covered with long yellow hairs. The species belongs to the tiger moth family, and has conspicuously-spotted forewings which entirely cover the body when the moth is at rest.

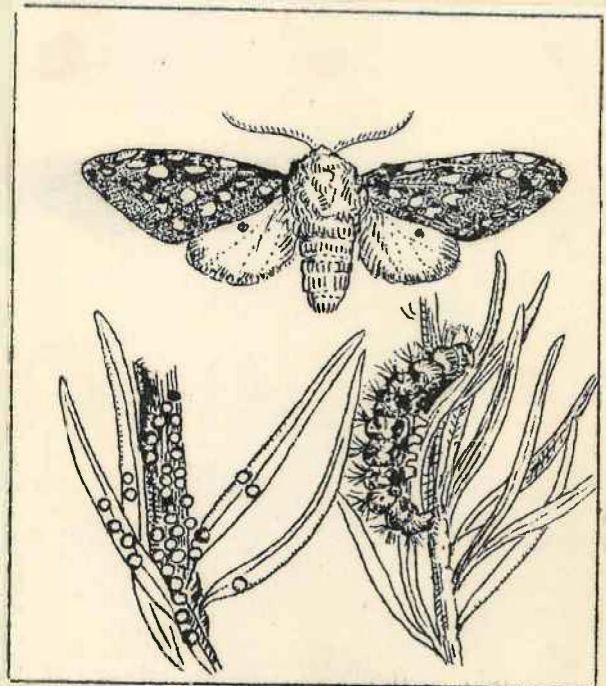
The rather large caterpillars are densely clothed with long brownish to black hairs, and feed in colonies on the host.

OCCURRENCE. This species has been found at only one place in the park, viz., the South Entrance.

HOST. Douglas fir.

HABITS AND SEASONAL HISTORY.

The adult moths emerge and fly during July and August. The pea-green eggs are deposited in clusters on the twigs and foliage of the host. As many as 325 eggs have been laid by one female moth. The hairy caterpillars feed in colonies on the foliage and are often found in dense clusters resting on the twigs. They hibernate in compact clusters in the dense foliage during the winter months. In June the mature caterpillars spin cocoons which are composed of silk and larval body hairs, in which they pupate. These cocoons are attached to the needles or twigs of the host.

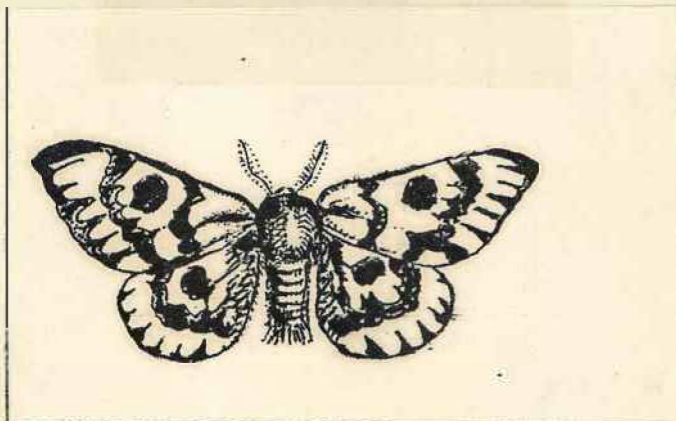


Adult male moth, eggs and caterpillar

LITERATURE

Packard, A.S. 1891 Fifth Report, U.S.Ent.Comm., p.773.

THE BROWN DAY MOTH
(Pseudohazis eglanterina Bdv.)



Adult Male, Brown Day Moth; Life-Size

DESCRIPTION. The adults are yellowish-brown in color, with black discs in the center of the wings and a black, wavy band on the outer margins. They are rather large moths, measuring nearly three inches in wing spread. The adults are day-flying and are very common within their range. The caterpillars are very conspicuous on account of their brilliant colors, long stiff bristles and large size. They measure nearly two inches and their bodies are covered with branched spines of black and tan color. They are marked with a narrow red line on each side and reddish spots on the dorsal surface. They occur singly and in clusters on the foliage of the hosts.

OCCURRENCE. The brown day moth is found locally at the South Entrance, where it is one of the most conspicuous forms of insect life in this locality. The caterpillars may be observed in June and July on Ceanothus and Douglas fir, the adults in late August and early September.

HOSTS. Douglas fir, Ceanothus spp.

HABITS AND LIFE HISTORY. The female moth lays her eggs in the fall in clusters around the stems of twigs and small branches. The salmon-colored eggs contrast strongly with the color of the support and may be distinguished at a distance of several feet. They hatch the following spring. The larvae feed on the foliage of the host and mature by July 15, later pupating in the ground litter. The adults emerge in August.

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- Dyar, H.G. 1894 Psyche, 7, p.91
Essig, E.O. 1926 Insects of the Western United States, p.672.

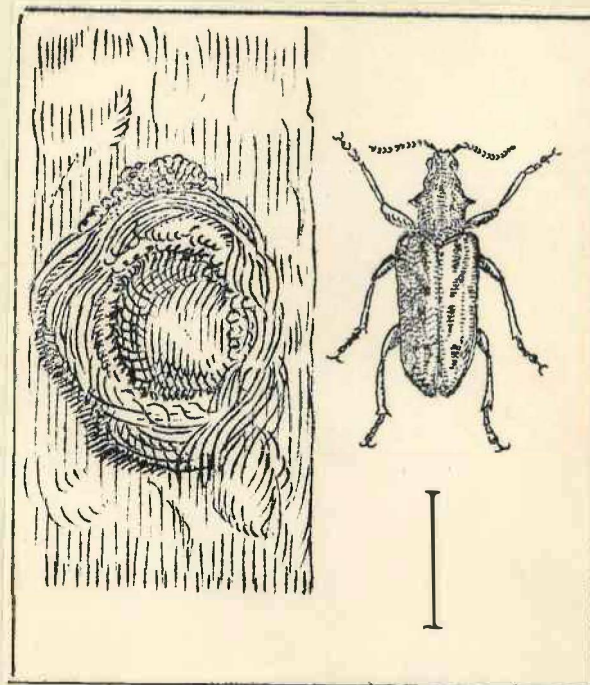
THE RIBBED PINE BORER
(Rhagium lineatum Oliv.)

DESCRIPTION. This wood borer is a gray beetle from $\frac{1}{2}$ to $\frac{3}{4}$ inch in length, with brownish markings on the elytra and a prominent spine on each side of the thorax. The larvae are found working under the bark of dead pines. They construct a very typical oval pupal cell between bark and wood, which is lined with long shreds of excelsior-like shavings.

OCCURRENCE. It occurs in the park throughout the pine stands and may be found locally in Pinnacles Valley, at Anna Spring and along the park highway above the South Entrance.

HOSTS. All the park pines.

HABITS. It attacks dead pines, the favorite breeding places being the lower trunk of standing trees and stumps.

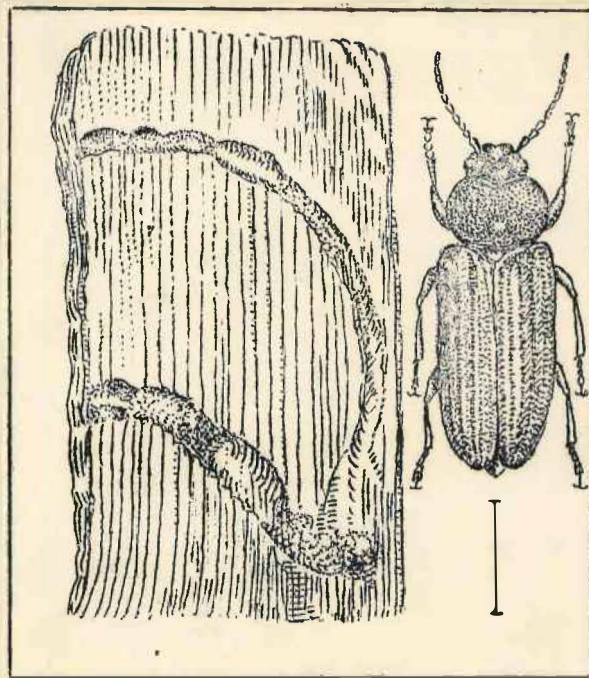


LITERATURE. Hess, W.N. 1920 Mem.
33, Cornell Univ. Agr. Exp. Sta.

Adult Ribbed Pine Borer
and Pupal Cell

THE BLACK SPRUCE BORER
(Asemum atrum Esch.)

The black spruce borer is a small black beetle about $\frac{1}{2}$ inch in length, and is found about deadenings in the forests. Being the most common wood borer of the park it will not fail to attract attention. The larvae bore in the sapwood of dying and dead trees, making rather large winding galleries in the solid wood. It occurs throughout the park, being common at Anna Spring, Government Camp and Lost Creek. The adults fly during July and August. The eggs are laid in bark crevices and the young larvae bore through to the sapwood. It attacks all the park pines and firs.



ADULT. BLACK SPRUCE BORER AND GALLERY

THE GOLDEN BUPRESTID
(Buprestis aurulenta Linn.)

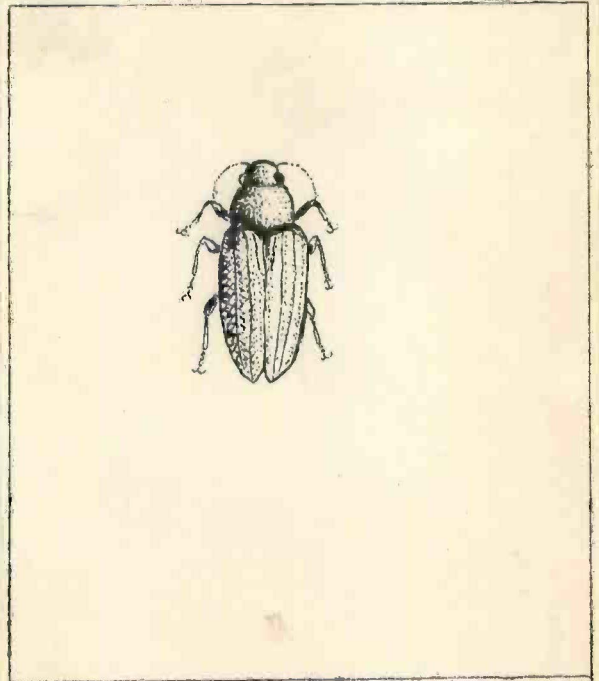
DESCRIPTION. The golden buprestid is one of the most beautiful beetles found in the park. The adults are a bright bluish-green, richly marked with gold and copper, and from $\frac{1}{2}$ to $\frac{3}{4}$ inch in length. Their bright colors may be distinguished even when the beetles are in flight, and are very conspicuous when the adults are resting on the trunk of a tree. They have a characteristic jerking walk, with intervals of hesitation between movements. Being one of the very common beetles of the park they are certain to attract attention. The larvae bore in the wood of all the park pines and are particularly attracted to fire scars or exposed pitch wood.

HOSTS. All the park pines and also Douglas fir.

OCCURRENCE. This beetle is found throughout the park and is particularly common in Munson Valley, at Anna Spring and in Pinnacles Valley. Local places where it should be looked for are the campground at the Rim, Sun Creek Meadows, Lost Creek Camp and Pole Bridge Camp.

HABITS AND SEASONAL HISTORY. The adults fly during the period from June 20 to early September. The eggs are laid on dying or dead branches and at the edge of scars on the main trunk of the host. The larvae enter the solid wood and feed for from 2 to 15 years before pupation. Pupae form in the late summer to early fall in cells at the ends of the larval burrows. The new adults appear in August and September, but do not emerge until the following spring and summer.

LITERATURE. Burke, H.E. 1909 Year Book, U.S.D.A., p.412.



Adult golden buprestid (enlarged)

THE RUSTIC BORER
(Buprestis rusticorum Kirby)

The rustic beetle is very similar in appearance and size to the golden buprestid but differs in coloration, being a dull rusty brown without the green and gold markings. Its habits and life history do not differ greatly. It attacks Douglas fir and is found throughout the park wherever this species occurs.

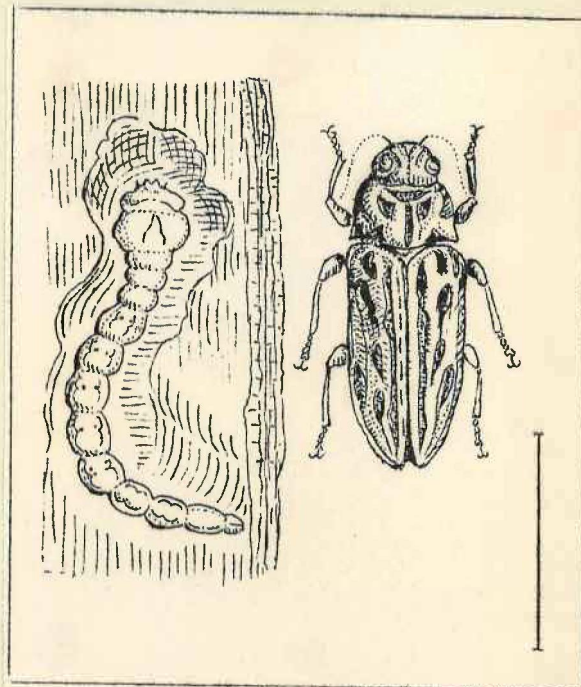
THE SCULPTURED PINE BORER
(Chalcophora angulicollis Lec.)

DESCRIPTION. The sculptured pine borer is the largest flathead borer found attacking the park pines. The adults are a dark metallic brown to black and are over an inch long. The rugose dorsal surface, with shiny metallic elevations, will at once distinguish the species. When disturbed they buzz away from their resting place on a pine trunk with a loud noise.

OCCURRENCE. The beetle occurs throughout the pine stands of the park. It is very common at the South Entrance and in Pinnacles Valley.

HOSTS. It attacks all the park pines.

SEASONAL HISTORY AND HABITS. The adults fly in July. Eggs are deposited in pits excavated by the females in the outer bark at the entrances to *Dendroctonus* ventilation and exit holes. The larvae bore in the wood of stumps and trunks of dying or dead trees. Pupae form in large oval cells just beneath the surface of the solid wood of infested material.



Adult beetle and grub
of the sculptured pine borer

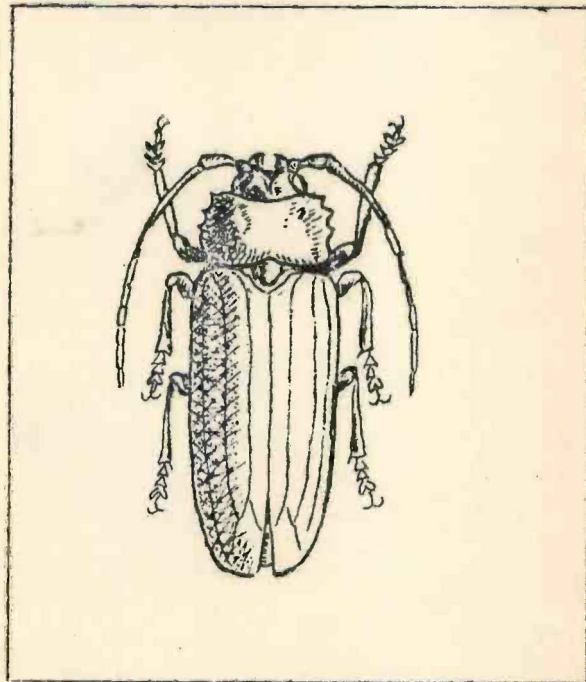
THE GIANT PINE BORER
(Ergates spiculatus Lec.)

DESCRIPTION. The adults are large brown beetles and are found flying to lights during summer nights or resting on or under the bark of old dead pines. They measure nearly 2 inches in length and are the largest timber beetles found in the park. The grub is certain to attract attention on account of its size, often measuring from 2 to 3 inches in length and $\frac{1}{2}$ inch in diameter. The grubs are often used as fish bait, for which purpose they are excellent. They may be found in old pine or fir stumps and in the base of dead trees.

OCCURRENCE. This beetle is found wherever host trees occur. It may be looked for in this park near the South Entrance, in Pinnacles Valley and on Castle Creek below White Horse. Preferred breeding places are roots, stumps, logs and standing trees that have been dead more than one year.

HOSTS. The pines and Douglas fir.

HABITS AND LIFE HISTORY. Adults emerge in July and August. Eggs are laid in crevices of the bark of stumps and at the base of dead trees. The larvae bore large tunnels in the sapwood and heartwood. Pupae form in large cells beneath the surface of the wood at the end of the larval burrows.



Adult giant pine borer

HARRIS' PINE BORER
(Tragosoma harrisi Lec.)

This large pine borer is very similar to the giant pine borer just described. It is, however, smaller, and inhabits the lodgepole pine forests of this park. The larvae feed in the dead wood of stumps and down logs. Adults may be found in such material in July and August. It occurs locally in Pinnacles Valley, at the East Entrance and at Lost Creek Camp.

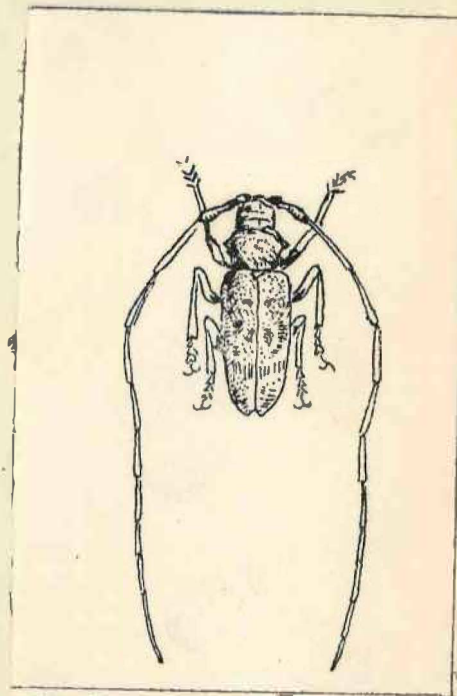
THE WESTERN PINE SAWYER
(Monochamus maculosus Hald.)

DESCRIPTION. The adult western pine sawyer is a mottled brownish beetle about 1 inch in length, with very long antennae. The males are more slender than the females and have longer antennae. Both have conspicuous spines on the lateral sides of the thorax. They are commonly found about dying trees and slash and attract attention because of their large size, long antennae and humming flight. When captured they emit a hissing sound and are prone to bite if held by the head. Their large mandibles make the bite severe.

OCCURRENCE. This beetle occurs throughout the park, being very common in Munson Valley, at Anna Spring and in Pinnacles Valley.

HOSTS. In this park the sawyer attacks lodgepole pine, Douglas fir and yellow pine.

HABITS AND SEASONAL HISTORY. The adults attack freshly-killed timber, down logs and slash of larger size. The eggs are deposited in the bark crevices. The young larvae bore through the bark to the sapwood and later excavate large tunnels which penetrate the heartwood. Pupal cells are made under the surface in the outer layers of the sapwood. The first feeding of the larvae is confined to the surface of the sapwood; and later, when they enter the solid wood, copious amounts of frass, which resembles fine excelsior, is thrown out and collects on the ground beneath their excavations. Pupae form in early July and the adults fly and attack during July and August. At other seasons the insect is in the larval stage.



Adult male
western pine sawyer

THE BLACK PINE SAWYER
(Monochamus oregonensis Lec.)

The only difference between this beetle and the western pine sawyer is in coloration, the present species being a glossy black with a few small white spots on the elytra. The habits and seasonal history of the two species do not differ. In Crater Lake Park the black pine sawyer attacks the firs and is found in stands of these trees. It may be found locally at Anna Spring and in Munson Valley.

LITERATURE. Hopping, Ralph 1921 A Review of the Genus Monochamus,
Sec.Can.Ent.,Vol.53,No.11,p.252.

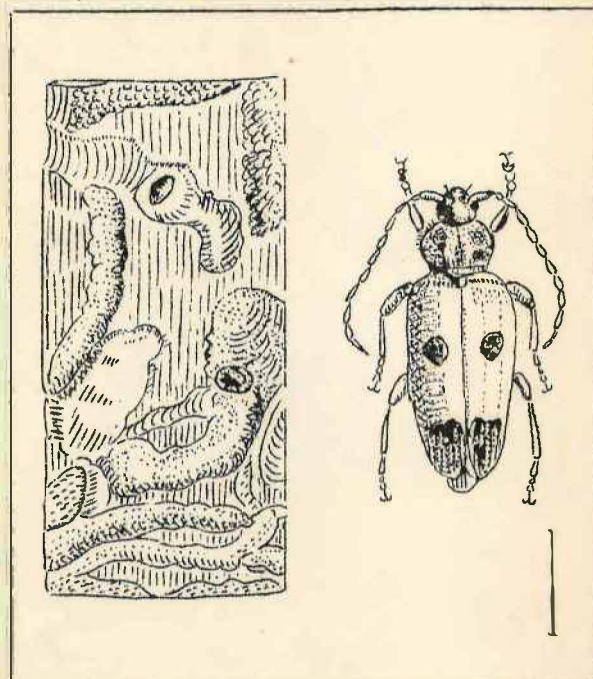
THE FIR SAPWOOD BORER
(*Semanotus ligneus* Fabr.)

DESCRIPTION. An elongated beetle from $\frac{1}{8}$ to $\frac{3}{4}$ inch in length, having a light-brown dorsal surface marked centrally by two greenish-black spots and with two larger areas of the same color on the posterior margin. Because of its bright coloration and prominent markings it will not fail to attract attention.

OCCURRENCE. It is found locally in the park at the South Entrance and adults may be observed in July about freshly-cut or broken incense cedar material.

HOST. Incense cedar. Varieties of this species attack Douglas fir and also white fir.

HABITS AND SEASONAL HISTORY. Its attacks are usually confined to down material or to dying strips on living trees. The eggs are laid in bark crevices; and after hatching the young larvae enter the inner bark and construct long straight to winding galleries which deeply score the sapwood. Pupae form in oval cells just under the surface of the sapwood. Eggs are laid in July and August. Larvae overwinter in galleries under the bark. Pupation begins early, so that all three stages--larvae, pupae and adults--are found in infested material during the early park season in July.

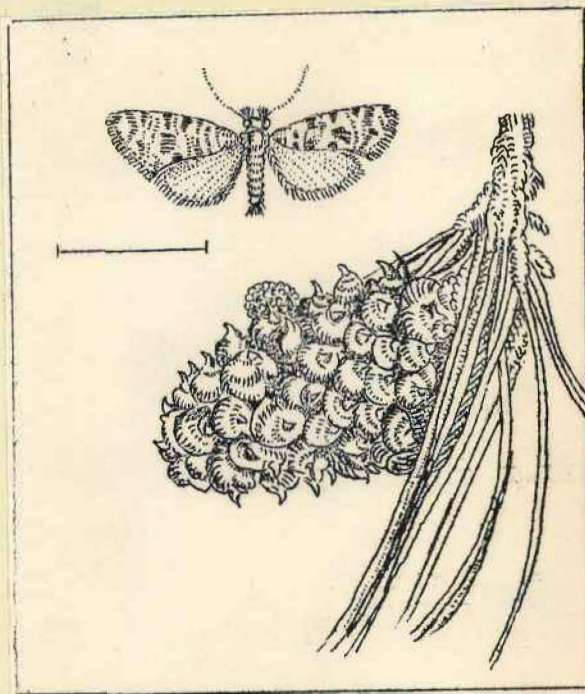


Adult fir sapwood borer
and specimen of larval galleries

LITERATURE. Van Dyke, E.C. 1923 *Bul. Brooklyn Ent. Soc.*, Vol. 18, No. 2, p. 50.

THE BROWN CONE MOTH
(Eucosma rescissoriana Hein.)

The adult brown cone moth is a light tan in color, with brick red wavy transverse bands across the forewings. It has a wing spread of about $\frac{3}{4}$ inch with a body length of $\frac{1}{2}$ inch. The caterpillars feed in lodgepole pine cones and destroy both cone tissue and seeds. Attacked cones may be readily recognized on account of their subnormal size and shriveled appearance. The feeding caterpillars push out large quantities of boring dust, which adheres to the cone surface in reddish masses. The adults fly in July in the park and are quite common in the lower-elevation lodgepole forests. The stands at the East Entrance are annually infested.



Adult brown cone moth and
infested lodgepole pine cone

THE FIR CONE MOTH
(Barbara colfaxiana Kearf.)

The adults are small tan and gray moths about $\frac{1}{2}$ inch long with mottled forewings. The caterpillars feed in Douglas fir cones, destroying both cone tissue and seeds. Pupae form in cocoons enclosed in a mass of pitch in the attacked cones. The adults fly in June and July and are common in the Douglas fir stands on lower Sun Creek and at the South Entrance.

THE WHITE FIR CONE MOTH
(Barbara colfaxiana siskiyouana Kearf.)

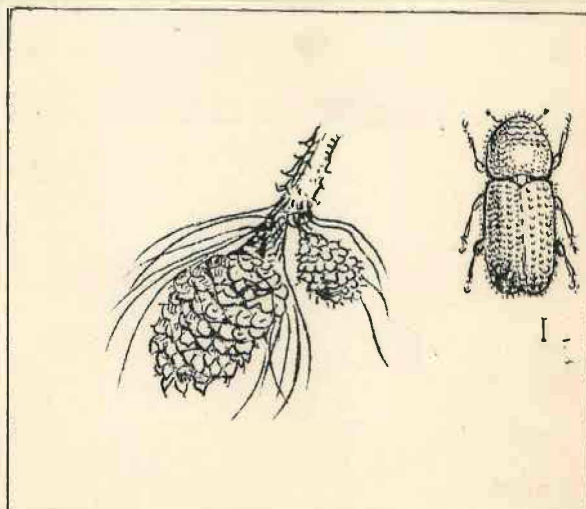
These moths are very similar to the preceding species and their habits are the same. They have more prominent wing markings and are a trifle larger. They attack both white and red fir cones and are common wherever these species occur. The adults fly in June and July and the eggs are deposited on the cone scales and bracts. They may be found locally at Anna Spring and on the west slope of Crater Peak.

YELLOW PINE CONE BEETLE
(Conophthorus ponderosae Hopk.)

DESCRIPTION. These beetles closely resemble the barkbeetles, though they are smaller. The adults are shiny black with a smooth upper surface and are about half the size of a housefly. The grubs are white and legless. The pupae are also white but possess the form of the adults. They may be found in dwarfed cones, either on the trees or on the ground under them.

OCCURRENCE. Locally at the South Entrance. Since this species attacks only yellow pine cones its range is restricted to that of this tree.

HABITS AND LIFE HISTORY. The adult attacks second-year cones by boring an entrance hole through the outer scales at the base of the cone to the pith of the cone axis. Here it makes a longitudinal gallery through the center of the cone and deposits eggs along the sides. Before the eggs are laid the parent beetle bores a groove around the stem of the cone just beneath the basal scales. This causes the cone to die quickly, assuring better conditions for the later brood development. The larvae feed in the center of the cones, eating both cone tissue and seeds. Pupae form in the cones and the new adults emerge through small exit holes drilled to the surface. The attacked cones are readily recognized by their dwarfed size (being less than one-half normal size), withered appearance and dark red color.



Yellow pine cone beetle enl. 5x.
Normal cone and attacked
aborted cone

LIFE HISTORY SYNOPSIS

Emergence of adults, flight and attack: May 15 to June 25.

Eggs: June 20 to July 1.

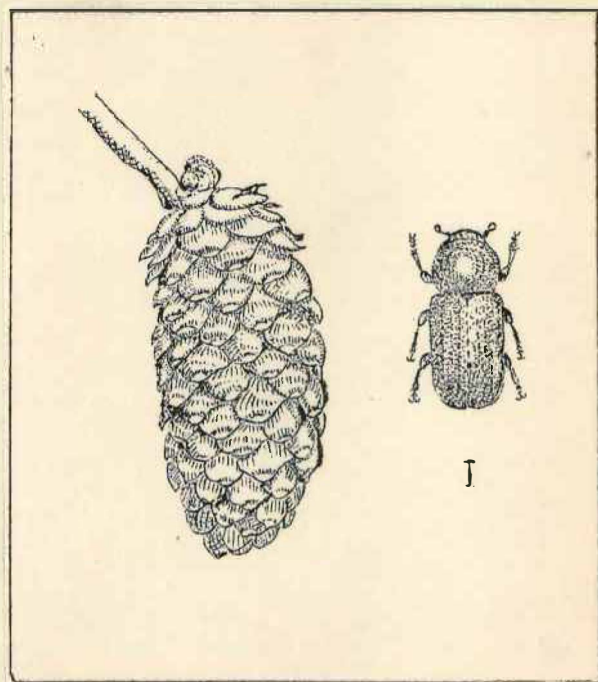
Larvae: June 1 to July 15.

Pupae: July 1 to August 15.

New Adults: July 20 to August 30. These overwinter in the cones, which are mostly retained by the tree, until the following spring.

THE SUGAR PINE CONE BEETLE
(Conophthorus lambertianae Hopk.)

This beetle cannot be readily distinguished from the preceding yellow pine cone beetle. Its life history is also similar, though it inhabits the cones of sugar pine. The mode of attack differs slightly in that the adults enter the cones by boring into the stem a short distance above the basal cone scales. The attacked cones are dwarfed and fall from the trees before they mature. The beetle is found locally in the park at the South Entrance.



Adult sugar pine cone beetle
and attacked cone

THE LODGEPOLE PINE CONE BEETLE
(Conophthorus contortae Hopk.)

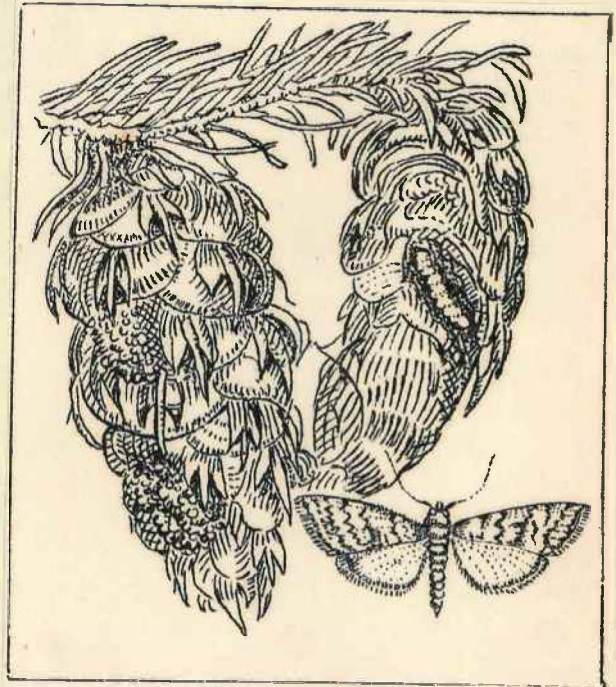
The adults are very similar to the two preceding, though smaller and darker in color. They attack lodgepole pine cones and are not uncommon in Pinnacles Valley and at Anna Spring.

LITERATURE

Miller, J.M. 1915 U.S.D.A. Bur.Ent.Bul.No.243.

THE CONE PYRALID
(*Dioryctria abietella* D&S)

DESCRIPTION AND HABITS. This cone moth is of a beautiful silvery-gray color, with dark wavy bands across the forewings. The wing expanse is about $1\frac{1}{2}$ inches. The larvae feed in the cones and twigs of lodgepole pine, mountain pine, yellow pine, sugar pine, and in the cones of white fir and Douglas fir. Infested cones show the destructive work of these caterpillars by their shriveled appearance and the usual mass of boring dust, which adheres in large masses to the surface of the cones over the food burrows. The mature larvae enter the ground and pupate in silky cocoons enclosed in a mass of sand and pebbles. The species occurs throughout the lower-elevation forests of the park, being common in Pinnacles Valley and on Anna Creek.



Adult cone Pyralid
and infested Douglas fir cones

THE CONE GEOMETRID
(*Eucymatoge spermophaga* Dyar)

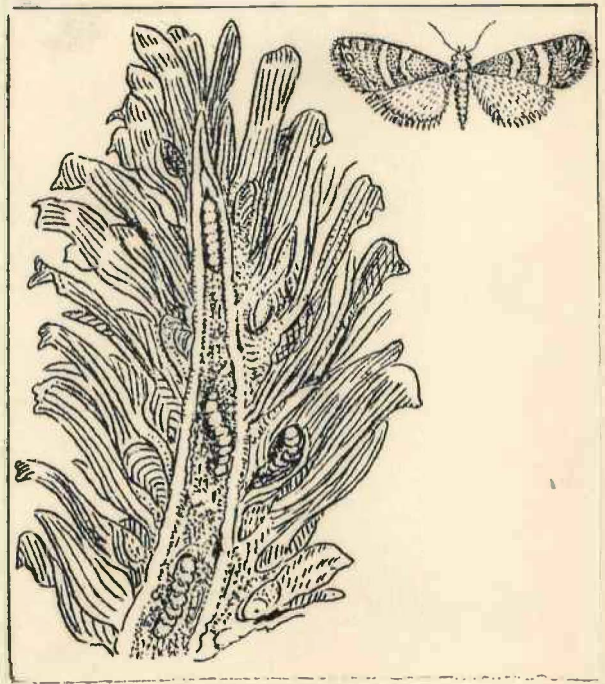
This species is very similar to the above. The adults are of a grayish-tan color. They also attack cones, and the greenish caterpillars make large food burrows in fir and hemlock cones. It is not common in the park, though adults may be found in the fir and hemlock forests during June and July.

THE CONE TINEID
(*Holcocera angusti* Hein.)

The cone tineid is a light tan and grayish moth about $\frac{1}{2}$ inch in length, very common in the Douglas fir at the South Entrance. The caterpillars feed in the cones and destroy large numbers of seeds. It is a rather inconspicuous moth which is attracted in large numbers to lights in camps.

Seed
THE YELLOW PINE ~~CONE~~ MOTH
(Laspeyresia piperana Kearf.)

The adults are small olive-brown moths with metallic bronze transverse bands across the forewings. They are about half an inch in length with a wing spread of nearly an inch. The caterpillars are dirty white in color, about half an inch in length, and have the habit of boring through the central pith of yellow pine cones and then entering the seeds through their attachment to the central stem. They destroy great quantities of seeds. The external appearance of attacked cones does not indicate the presence of the caterpillars within, although upon opening them the work, or the caterpillars themselves are disclosed. The adults are common in the yellow pine stands at the South Entrance during the flight period, which is in June and July.



Adult yellow pine cone moth and
larvae within yellow pine cone

Seed
THE SPRUCE ~~CONE~~ MOTH
(Laspeyresia youngana Kearf.)

The spruce cone moth is almost an exact counterpart of the yellow pine cone moth, though only about half its size. Its habits and seasonal history do not greatly differ. The moth attacks Engelmann spruce and the caterpillars feed in the cones of this tree. They are very common in the spruce stands in the canyons of Anna Creek and Sand Creek.

THE SEED CHALCIDS

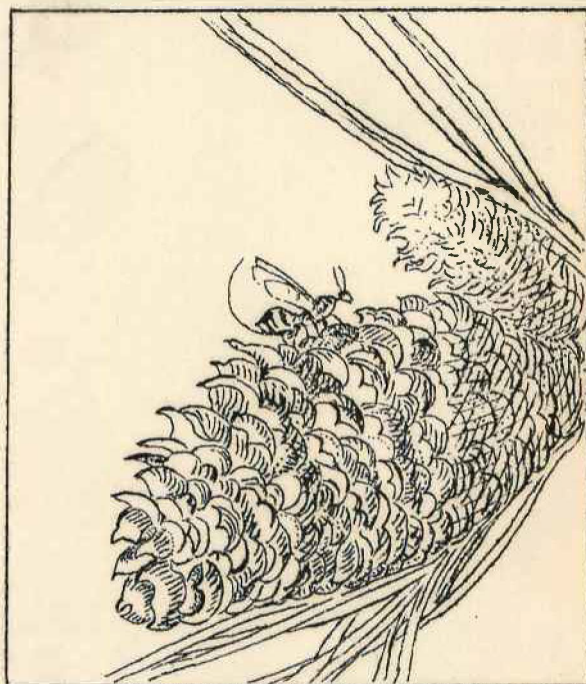
The seed chalcids are small wasp-like insects which attack the seeds of conifers. They are very plentiful in the park but on account of their small size are easily overlooked. The adult wasps drill their ovipositors through the young green cones and lay their eggs in the seeds. The worms upon hatching feed upon the growing tissues within the seeds and completely destroy them. The wasps may be found in the cones of the species they attack. The adults fly during the spring and early summer months.

THE PINE SEED CHALCID (Megastigmus albifrons Walk.)

This species is the largest of the park seed chalcids. They are about half an inch long and of a brownish-black color. The female has a long, up-curved ovipositor and is larger than the male. The marginal sketch illustrates a female attacking a yellow pine cone. This species is common at the South Entrance and attacks the cones of western yellow pine.

THE FIR SEED CHALCID (Megastigmus pinus Parfitt)

A smaller species, otherwise closely resembling the pine seed chalcid. Their habits are the same, though the hosts are white and red fir cones. They are common in forests of these species.



Adult pine seed chalcid
ovipositing on yellow pine cone

THE DOUGLAS FIR SEED CHALCID (Megastigmus spermotrophus Wach.)

Smaller than the preceding and of a lemon-yellow color. Attacks the cones of Douglas fir and is found locally in the park at the South Entrance.

THE SPRUCE SEED CHALCID (Megastigmus picea Roh.)

Similar to the fir seed chalcid but less than half its size. Attacks Engelmann spruce cones and is found in the canyons of Anna Creek and Sand Creek.

THE HEMLOCK SEED CHALCID
(Megastigmus tsugae Roh.)

The adults are similar to the last, though smaller and of a lighter color. They infest cones of the mountain hemlock and are common at Anna Spring and in Munson Valley.

LITERATURE

- Miller, J.M. 1914 U.S.D.A.Bul.No.95, "Insect Damage to the
Cones and Seeds of Pacific Coast Conifers"
- 1916 Jour.Agr.Res.,Vol.6,No.2, "Oviposition of
Megastigmus spermotrophus in the Seed of
Douglas Fir."